March 24, 2004

To:

United States Patent Office
Washington D.C.
Fax #: 703-872-9306

Application Ref. Number 09/560,518
Attn: Marianne Padget

From:

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Supporting documents being sent via USPS.

Rick B.

From: "Rick B." <vze42yrp@verizon.net>
To: "Marianne Padget" <marianne.padget@uspto.com>
Sent: Wednesday, March 24, 2004 3:52 PM
Attach: 11-18-03 patent defense.doc; CPL2003.pdf; ibadex_jhpaper.doc; YB-66 Crystal After Ion Erosion Inside.ppt; melted target crystal.jpg
Subject: U.S. Pat. Applic:09/560,518

Dear Inspector Padget,

The first attachment is an earlier letter I thought you had gotten.

I respectfully submit that there is a fundamental difference between JP 7-245409A, Kataoka, et.al. assigned to Mitsubishi Electric Corp. and my application 09/560,518. The primary difference is that Kataoka claims to sputter a coating of YB_66 for oxidation prevention, whereas, I am claiming to sputter a coating of _pure boron clusters_. YB_66 (also more broadly expressed as MB'66, or MB_xxx) is simply representative of an extended subset of compounds and a mechanism described thoroughly in my previous patent 5,861,630, in which the boron component of the compound _preferentially dissociates from the rare earth component_ as a highly reactive and/or self-assembling boron cluster ion. I chose YB_66 as typical, in the strict sense of the word, because it is the common, default, research material referenced to, in what literature there is.

Once again, the claim you objected to the most, if I remember correctly, was was Kataoka's linking of the sputtering process and YB_66. My experimental work of the last several years, and the previous patent, is _based on the fact_ that these materials dissociate in the form of self-assembled ionized boron clusters in the vapor/plasma state, which have novel properties distinct from YB_66. The boron cluster ions become highly reactive once they have dissociated from the parent compound, (YB_66, et. al.), and then are free to recombine in a wide variety of cluster morphologies. Reactions with other atomic and molecular species will form a whole new branch of boron chemistry, which has yet to be explored. Potential areas of immediate benefit may be, include, but are not limited to, hydrogen storage; superconductivity; spin physics; energy efficient window coatings; nuclear medecine such as Boron Neutron Capture Therapy (BNCT) for cancer, and Syvenectomy for arthritis; new bioceramics; super-magnets; many applications in aerospace and defense; untold numbers of exotic new ceramic, metalic, and molecular compounds with unforseeable properties, and so on. Boron clusters and nanostructures are analogous to carbon clusters and nanostructures, but with much greater commercial potential. Thin films of the boron clusters, and/or boron cluster-based compounds, using sputtering as one of many common industrial techniques, promise to open borides to Materials Science. It is predicted that interchanging the M component and/or the B_xxx stoichiometry, will significantly alter the physio-chemical properties. I am working with teams at a number of universities to systematically explore this potential.

The recently published article from Chemical Physics Letters 2003, is attached as further peer-reviewed evidence. I have extensive substantiating experimental evidence in support of this dissociation mechanism, if you so desire.

In the case of classical Thermal Plasma-Spray Deposition and other thick film techniques as a means of making coatings, the exploitation of the low-energy properties of the MB_xxx family, the crystaline MB'66 takes advantage of the fact that the MB_xxx material does not have sufficient energy to dissociate completely, and retains it's properties as a compound.

These properties are useful for such things as superhard tribological coatings, such as would be valuable in jet turbine impeller blades working in a sand-rich environment. Other potential coating applications would include, but are not limited to, such things as hip implants, rocket nozzles, piston rings and other wear-sensitive components, internal component protection of Tokamack Fusion Reactors, new ceramic-matrix and nanostructured materials for engineering applications, etc..

Any method of deposition of either the reactive cluster-based materials, or the stable MB_xxx precursors may be combined with any other process to create or enhance the formation of, and properties of surface coatings. Thermal diffusion is mentioned as one of the many methods commonly used to change surface properties of materials.

To see a partial zoo of these morphologies, visit:
[illegible]. Boron nano- sheets, wires, spheres, plates, tubes, bundles, etc., in this series of SEM photographs were all taken from a single small sample run, where a polycrystal of YB_66 was used as an ablative source of cluster-rich vapor/plasma. (melted target crystal jpj, YB-66 crystal after Ion...)Being able to control and understand the complex mecanisms involved in the formation of these morphologies, depends on sputtering as a primary research technique.

Respectfully,
Rick K Becker
3/24/04

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